



US009636352B2

(12) **United States Patent**  
**Sun et al.**

(10) **Patent No.:** **US 9,636,352 B2**  
(45) **Date of Patent:** **May 2, 2017**

(54) **COMPOSITIONS AND METHODS FOR THE TREATMENT OF MUSCULOSKELETAL RELATED DISEASES AND DISORDERS USING METAL ION-CITRATE ANALOG COMPLEXES**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 169 days.

(21) Appl. No.: **13/418,125**

(22) Filed: **Mar. 12, 2012**

(65) **Prior Publication Data**  
US 2012/0238521 A1 Sep. 20, 2012

#### Related U.S. Application Data

(60) Provisional application No. 61/453,401, filed on Mar. 16, 2011.

(51) **Int. Cl.**  
**A61K 31/6615** (2006.01)  
**A61K 31/194** (2006.01)  
(Continued)

(52) **U.S. Cl.**  
CPC ..... **A61K 31/6615** (2013.01); **A61K 31/194** (2013.01); **A61K 31/555** (2013.01); **A61K 31/661** (2013.01); **A61K 31/664** (2013.01)

(58) **Field of Classification Search**  
CPC .. A61K 31/194; A61K 31/555; A61K 31/661; A61K 31/6615; A61K 31/664  
See application file for complete search history.

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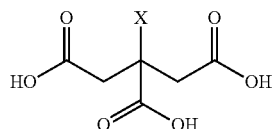
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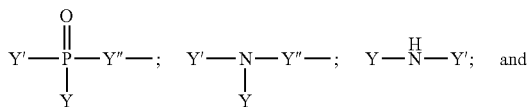
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(57) **ABSTRACT**

The invention is directed to a composition and associated method for the treatment of musculoskeletal related disorders and diseases. In particular, the present invention provides a class of citrate compounds that can be used to for the treatment of diseases/disorders characterized by the degeneration of musculoskeletal tissues including menisci, bone, articular cartilage, and soft tissues. Examples of suitable citrate and citrate analog compounds include citrates having the following base formula (I):



where X may be one of the following:



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